

through said hole of the electrode terminal and engaging threadedly with the female screw hole at one end while projecting from the upper surface of the electrode terminal at the other end,

Cont'd
B1 wherein said electrode plate for external connection is electrically connected with said electrode terminal on the outer surface of the case by placing said electrode plate so that the male screw member passes through said hole of the electrode plate, and then engaging a nut with the male screw member.

REMARKS

Favorable reconsideration of this application as presently amended and in light of the following discussion is respectfully requested.

Claims 1-8 are pending in the present application. Claim 1 has been amended by the present amendment.

In the outstanding Office Action, Claims 1, 2, 4, 6 and 8 were rejected under 35 U.S.C. § 103(a) as unpatentable over Matsumoto et al in view of Applicant's admitted prior art (AAPA) and Kauo et al; Claim 3 was rejected under 35 U.S.C. § 103(a) as unpatentable over Matsumoto et al, AAPA, and Kauo et al in view of Takegawa; and Claims 5 and 7 were rejected under 35 U.S.C. § 103(a) as unpatentable over Matsumoto et al, AAPA, and Kauo et al in view of Abe.

Claims 1, 2, 4, 6 and 8 stand rejected under 35 U.S.C. § 103(a) as unpatentable over Matsumoto et al in view of AAPA and Kauo et al. This rejection is respectfully traversed.

The present invention as recited in Claim 1 is directed to a power semiconductor module including an electrode terminal connected with an electric power semiconductor device which is resin sealed inside of a case at one end while having a hole and exposed

along a side of an outer surface of the case at the other end, and an electrode plate for external connection having a hole and arranged to overlie said electrode terminal on outer surface of the case. Further, a female screw hole is provided on the outer surface of the case so as to correspond to said hole of the electrode terminal and a male screw member has screw threads disposed on both ends. The male screw hole penetrates through the hole of the electrode terminal and engages threadedly with the female screw hole at one end while projecting from the upper surface of the electrode terminal at the other end. Further, the electrode plate for external connection is electrically connected with the electrode terminal on the outer surface of the case by placing the electrode plate so that the male screw member passes through the hole of the electrode plate, and then engages a nut with the male screw member.

Thus, the present invention provides a connection structure between an external connecting electrode and an electrode terminal of a power semiconductor module on an exterior case for a power semiconductor module, which is capable of using an existing power semiconductor module as it is, capable of easily positioning an external connection electrode with respect to an electrode terminal, and capable of realizing efficient assembly operations (see page 3, lines 7-15).

For example, as shown in Figure 2, the male screw member 9 includes a first screw threadedly engaging with the female screw hole 5, and a second screw end projecting from the upper surface of the electrode terminal 3 such that it is capable of receiving a removable fastening member 11 (see the fastening nut 11 shown in Figure 2, for example). Further, an electrode plate 7 includes a hole 8 and is arranged to overlie the electrode terminal 3 on an outer surface of the case. The female screw hole is provided on the outer surface of the case so as to correspond to the hole 8 of the electrode terminal 3. The electrode plate 7 is

electrically connected with the electrode terminal on the outer surface of the case by placing the electrode plate 7 so that the male screw member 9 passes through the hole of the electrode plate and the engages with a nut (specification, page 10, lines 8-25). Therefore, it is possible to easily position the electrode plate 7 such that the center axis of the insertion hole 8 of the electrode plate 7 coincides with the center axis of the insertion hole 4 of the electrode terminal 3. In this case, it is unnecessary to hold the electrode plate 7 at a predetermined position while fastening. Thus, it is possible to shorten the time required for electrically connecting both the members. Further, in this case, the existing power semiconductor module can be used as it is, and the above described effect can be obtained without increasing the cost (see page 11, lines 1-11).

The outstanding Office Action recognizes Matsumoto and AAPA do not teach the feature of the claimed invention in which the second screw end is configured to receive a removably fastening member but relies on Kauo et al as teaching this feature. In particular, the outstanding Office Action states Kauo et al use a male screw member having a second threaded end where the second end is configured to receive a removable fastening member 17.

However, Applicant notes Kauo et al is directed to PTC electric heating element assemblies, whereas the present invention is directed to a power semiconductor module. Applicant submits one skilled in the art would not look to the non-analogous art of PTC electric heating element assemblies for the claimed feature, because the assembly of power semiconductor modules is more delicate and intricate than that related to PTC electric heating elements. Accordingly, Applicant submits Kauo et al is non-analogous art, and therefore does not render the claims unpatentable.

Further, regarding Claim 4, the outstanding Office Action indicates it would have been an obvious matter of design choice to change the size of the screw member such that its opposite ends have different diameters, since a modification would have involved a mere change in the size of the component.

Applicant notes Claim 4 recites that the male screw member includes different nominal diameters at opposite ends. For example, Figure 4 illustrates a member whose nominal diameter is varied in the middle of its longitudinal direction as a male screw member 39 which is threadedly engaged with the terminal nut 5 fixed on the side of the outer surface of the exterior case 2. That is, the male screw member 39 includes a small-diameter portion 39a corresponding to a female screw of the terminal nut 5, and a large-diameter portion 39b having a nominal diameter greater than the small-diameter portion 39a. In this instance, a nut greater than the terminal nut 5 is used as a fastening nut which is threadedly engaged with the large-diameter portion 39b. That is, nuts having different size are use for the small-diameter portion 39a and the large-diameter portion 39b. When the male screw member 39 is mounted, as a small-diameter portion 39a is threadedly engaged with the terminal nut 5, the male screw member 39 is restricted at a position where a lower end of the large-diameter portion 39b abuts against an upper surface of the terminal nut 5, and this controls the length of the male screw member 39 projecting outward (see page 12, third embodiment).

As a result, it is easy to position the male screw member 39 with respect to the exterior case 2, and the power semiconductor module can be assembled more efficiently. Accordingly, the subject matter recited in Claim 4 provides specific advantages related to the power semiconductor module which Applicant submits are not a mere matter of design choice.

Claim 3 stands rejected under 35 U.S.C. § 103(a) as unpatentable over Matsumoto et al, AAPA and Kauo et al in view of Takegawa. This rejection is respectfully traversed.

Claim 3 depends on Claim 1, which as discussed above is believed to be allowable. Further, it is respectfully submitted Takegawa also does not teach or suggest the features recited in independent Claim 1. Therefore, it is respectfully requested this rejection also be withdrawn.

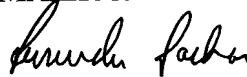
Claims 5 and 7 stand rejected under 35 U.S.C. § 103(a) as unpatentable over Matsumoto et al, AAPA and Kauo et al in view of Abe. This rejection is respectfully traversed.

Claims 5 and 7 depend on Claim 1, which as discussed above is believed to be allowable. Further, it is respectfully submitted Abe also does not teach or suggest the features recited in independent Claim 1. Therefore, it is respectfully requested this rejection also be withdrawn.

Consequently, in light of the above discussion and in view of the present amendment, the present application is believed to be in condition for allowance and an early and favorable action to that effect is respectfully requested.

Respectfully submitted,

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IN THE CLAIMS

Please amend Claim 1 as shown below:

--1. (Twice Amended) A power semiconductor module, comprising:

[at least one] an electrode terminal [each including,

a first end] connected with an electric power semiconductor device which is resin sealed inside of a case[, and

a second end exposed along an outer surface of the case for taking out the at least one electrode terminal from the semiconductor device and configured to electrically connect to an electrode thereby forming an external connection disposed on the electrode terminal] at one end while having a hole and exposed along a side of an outer surface of the case at the other end;

an electrode plate for external connection having a hole and arranged to overlie said electrode terminal on an outer surface of the case;

a female screw hole provided on [a side of] the outer surface of the case so as to correspond to said hole of the electrode terminal; and

a male screw member having screw threads disposed on [at least each of a first screw end and a second screw end, said first screw end is] both ends, penetrating through said hole of the electrode terminal and engaging threadedly [engaged] with the female screw hole[, and a portion of said male screw extends through the electrode terminal] at one end while projecting from the upper surface of the electrode terminal at the other end,

wherein said [second screw end is configured to receive a removable fastening member] electrode plate for external connection is electrically connected with said electrode terminal on the outer surface of the case by placing said electrode plate so that the male screw member passes through said hole of the electrode plate, and then engaging a nut with the male screw member.--